Investigation of a Water-Damaged Office Building: Health and Environmental Assessment

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Study Objectives

- To assess prevalence of respiratory disease in the building
- To examine relationships between microbiological agents and respiratory disease

Building Description

- 20-story building
  - Floors 1- 4: Garage
  - Floor 5: Cafeteria, Garage, Lobby, office
  - Floor 6, 14-20: DRS
  - Floor 7-12: DSS
- Built in mid-80s
- DPW in 1994
  - 1300 employees work in the building

Questionnaire Administration

- **Questionnaire**
  - **Demographics, smoking history, work history**
  - **Upper and lower respiratory symptoms**
  - **Systemic symptoms**
  - **Physician-diagnosed asthma, HP and sarcoidosis**
- **Offered to all 1327 employees working in building**

Comparison of prevalences

Study	Cough (%)	Wheeze (%)	SOB (%)	Chest Tightness (%)	Asthma Dx (%)	PO onset, asthma Dx (%)
Building (N = 888)	**14.8**	**6.9**	**9.6**	**11.3**	**17.7**	**7.4**
Building (N = 1327)	**9.9**	**4.6**	**6.4**	**7.6**	**11.8**	**5.0**
Malkin et al. (problem bldgs), 1996	**9**	**4**	**5**	**6**	**12**	**3**
Apte et al. (non-problem bldgs), 2000	**5.5**	**2.4**	**2.1**	**2.4**		

Wheezing & Asthma

Standardized Questions	Building Prevalence (%)	Prevalence Ratio	95% Confidence Interval
Wheezing (vs. NHANES III)	**35.9**	**2.5**	**2.2–2.8**
Asthma, ever (vs. NHANES III)	**17.7**	**2.2**	**1.9–2.6**
Asthma, current (vs. NHANES III)	**12.8**	**2.4**	**2.0–3.0**
Asthma, current (vs. BRFSS-CT)	**12.8**	**1.5**	**1.3–1.9**

N = 888 (68% participation rate)

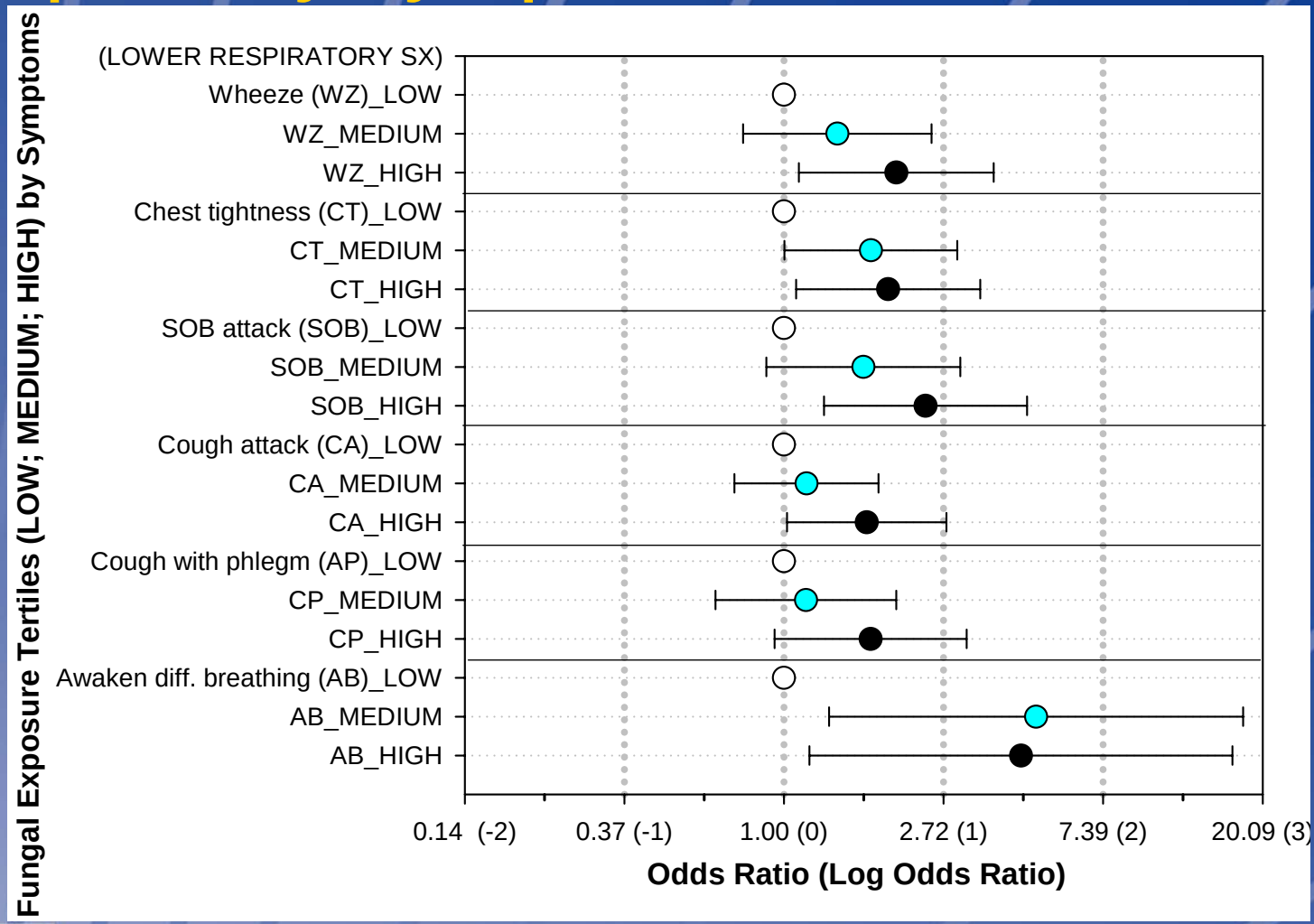
Environmental Sampling Plan

- **Chair and carpet dust sampling**
  - **1 chair and 2 m^2 at each workstation**
- **Dust homogenized, weighed and analyzed**
  - **Dog (Can f 1), cat (Fel d 1), cockroach (Bla g 2) and dust mite (Der p 1 and Der f 1) allergens**
  - **Mouse urinary protein (Mus m 1)**
  - **Endotoxin**
  - **Culturable fungi**
  - **Ergosterol**

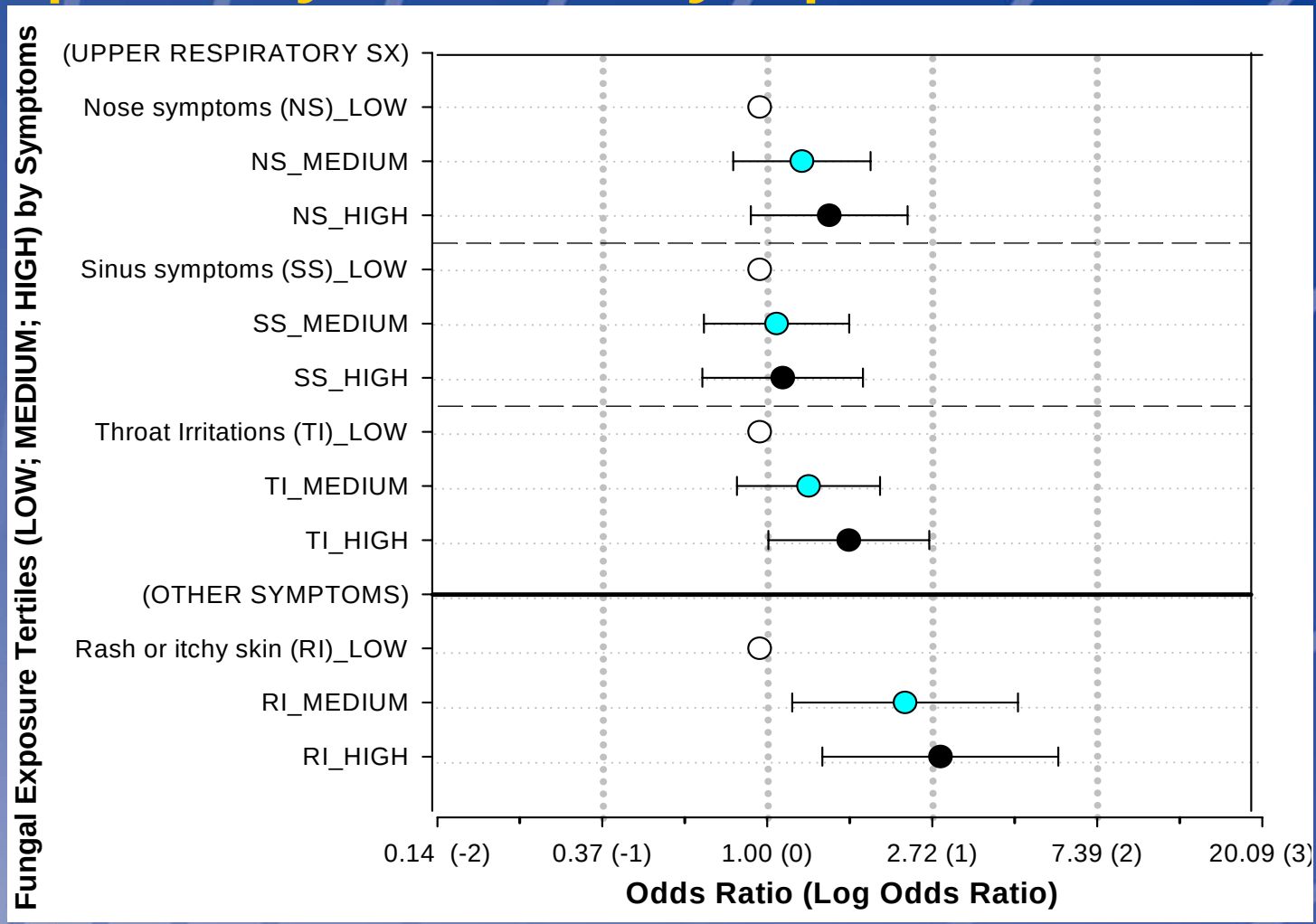
Categorization of fungal concentrations – Assigned to full cohort (N=888)

Unit of measure	Tertile of exposure		
	Low	Medium	High
Average levels (ranges) of culturable fungi			
CFU/mg dust	4.9 (3.9-5.8)	7.9 (6.2-8.9)	12.5 (10.0-21.6)
CFU/m^2 area	800 (600-1,200)	1,800 (1,400-2,100)	4,400 (2,200-7,800)

Relationships between fungi and lower respiratory symptoms



Relationships between fungi and upper respiratory or skin symptoms



Prevalent Case-Control Study

- **Asthma case group definition (n=123*)**
  - **Lower respiratory symptoms in the last 4 weeks, or**
  - **Post-occupancy asthma diagnosis**
- **HP-like case group definition (n=130*)**
  - **HP-like symptoms in the last 4 weeks, or**
  - **Post-occupancy hypersensitivity pneumonitis diagnosis**
- **Comparison group definition (n=154)**
  - **Employees who reported no chest problems**

* 59 participants met both case definitions

Asthma- and HP-like symptoms

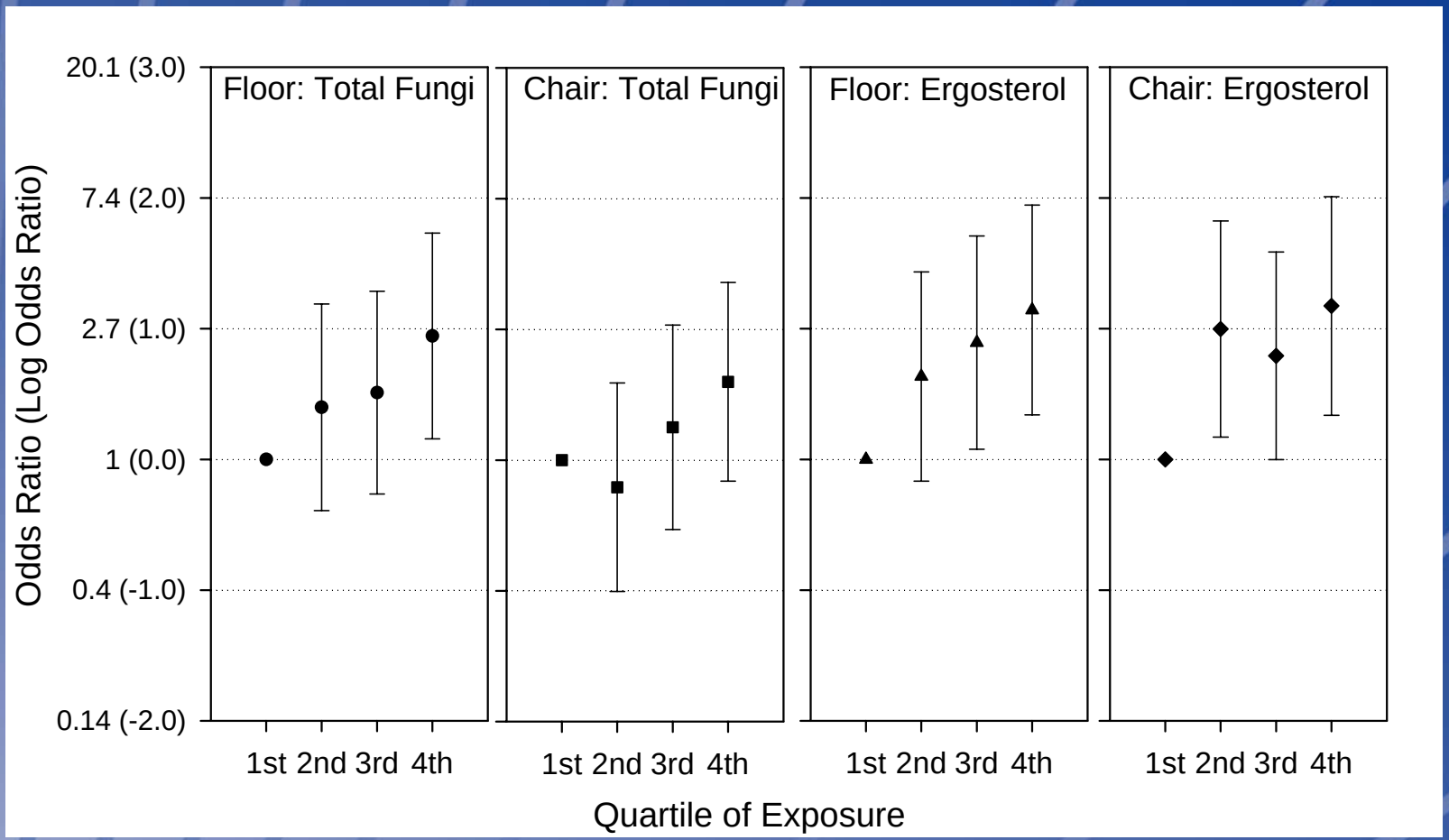
- **Asthma-like**
  - Wheezing or whistling in chest
  - Chest tightness
  - Attacks of shortness of breath
  - Coughing attack
  - Awaken by an attack of breathing difficulty
- **Hypersensitivity pneumonitis-like**
  - Shortness of breath when hurrying on the level or walking up a slight hill
  - Episodes of fever and chills
  - Episodes of flu-like achiness or achy joints

Association between exposures to microbiological agents in settled dust and respiratory effects

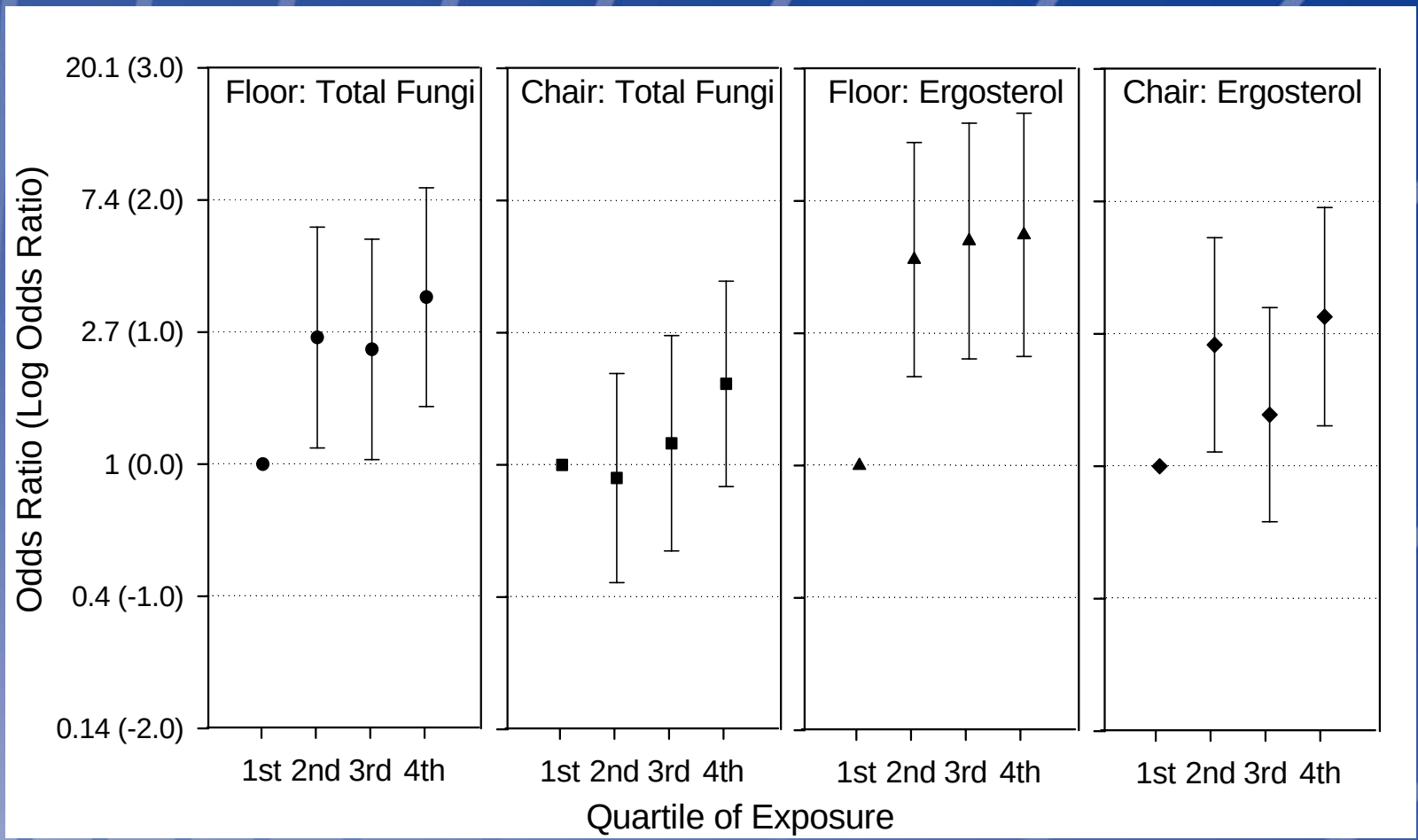
	Asthma		HP-like	
Environmental variable	N	Adjusted Odds Ratio*	N	Adjusted Odds Ratio*
Total culturable fungi				
Floor dust (cfu/m^2)	235	1.29 (1.10-1.52)	235	1.30 (1.09-1.54)
Chair dust (cfu/chair)	236	1.23 (1.05-1.45)	234	1.22 (1.03-1.44)
Ergosterol				
Floor dust (ng/m^2)	240	1.36 (1.10-1.69)	239	1.53 (1.21-1.94)
Chair dust (ng/chair)	235	1.36 (1.03-1.79)	233	1.40 (1.06-1.85)
Endotoxin				
Floor dust (EU/m^2)	242	1.21 (1.02-1.45)	239	1.30 (1.07-1.57)
Chair dust (EU/chair)	237	1.06 (0.83-1.37)	235	1.18 (0.89-1.56)

*Adjusted for gender, race, age, building tenure, smoking status

Relationship between fungi and asthma symptoms



Relationship between fungi and HP-like symptoms



Limitations

- Reporting bias
- Participation bias
- Exposure misclassification
  - Temporal
  - Carpet cleaning
- Settled dust as a surrogate exposure marker

Conclusions

- There are apparent excesses of asthma and lower respiratory symptoms
- Respiratory health effects are associated with microbiological agents in floor and chair dusts

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